

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Future Space Transportation Systems (4)

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## LAUNCH VEHICLE OF THE FUTURE

**Abstract**

Multi-stage launch vehicles have always been the epicenter for wide-eyed dream and realization of space explorations. However, with the average of newer technologies and breakthroughs in this particular field, we have always encountered a question i.e. can the cost effectiveness and the material loss of multi-stage rockets be entertained forever?

This brings us to the concept of reusable launch vehicle and single stage to orbit (SSTO's). This paper gives a detailed account of the current scenarios and recurring obstructions in the path of ongoing research in this area. The paper deals with the basic design problems first, by providing a spherical design with modifications for the SSTO. It is well known that, for a SSTO program, huge amount of propellant is needed and the SSTO's spherical design provides a large volume on a comparatively low surface area. The vehicle has been designed by taking in account, the aerodynamic considerations and solutions to overcome the aerodynamic interferences. The other major problem in the form of choosing the propellant. Thus a keen research and a comparative study are made considering the propellants available on worldwide scale. For the vehicle, we have done a major amount of study on propane, as a prospective propellant. There are certain stoichiometric modifications and alterations done on the prospective propellant to match it to requirements of the SSTO.

Despite of the above stated obstructions, the third major difficulty arises from the speed of the vehicle itself. For reaching the orbit and re-entry. The vehicle in the whole process might even go to a speed of mach 28 or faster at mach 32. Such amount of heat may cause great material damage. However, this problem is not considered major as for e.g. Apollo 13, which survived mach 32, with basic heat insulation techniques used by NASA, still a cost effective solution is provided in this paper. The paper discusses various material specifications and insulation mechanisms, to overcome this problem.

A major aspect of the paper is that it provides a cost-effective solution to the above stated problems and show a new way to the human endeavor of space exploration.